

Diocesan Boys' School
G12 Final Examination
Jan 2023

BIOLOGY PAPER 2

11:30 am - 12:30 pm (1 hour)

This paper must be answered in English

Name	Max chee Man Hon
Class	12D
Class no.	10

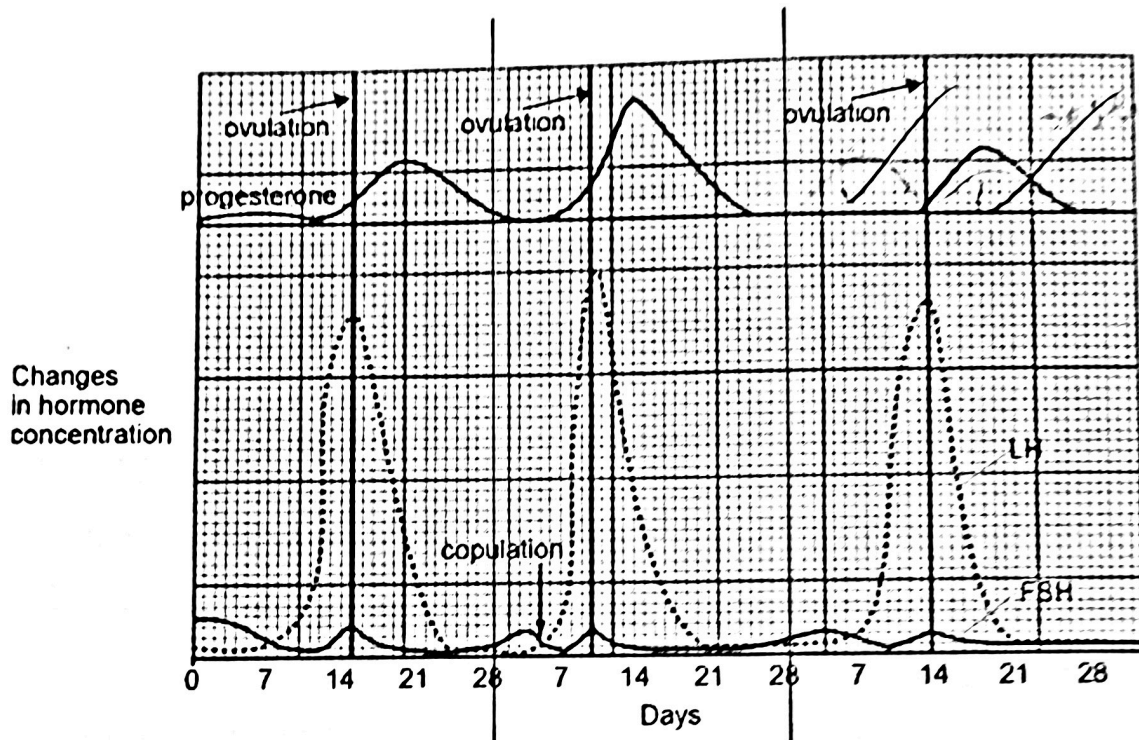
INSTRUCTIONS

- (1) There are **THREE** sections, A, B and C in this paper. Attempt **ALL** questions in any **TWO** sections.
- (2) Write your answers in the Answer Book provided. Start each question (not part of a question) on a new page.
- (3) Present your answers in paragraphs wherever appropriate.
- (4) Illustrate your answers with diagrams wherever appropriate.
- (5) The diagrams in this paper are **NOT** necessarily drawn to scale.

SECTION A Human Physiology: Regulation and Control

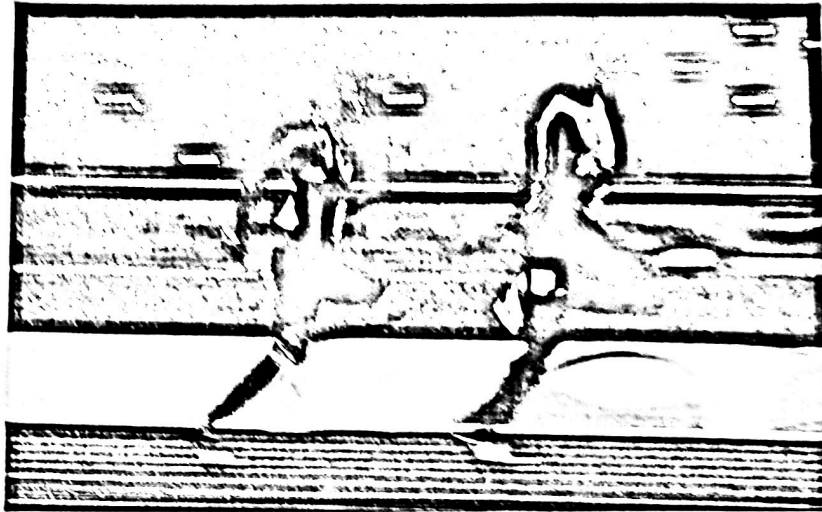
Answer ALL parts of the question.

1. (a) Reproductive cycles in humans are controlled by changes in hormone concentrations and affected by copulation (sexual intercourse). The graph below shows the changes in concentration of lutenizing hormone (LH), follicle-stimulating hormone (FSH) and progesterone during three consecutive cycles of a woman.



- (i) Explain how the increase in progesterone concentration was brought about after ovulation. (2 marks)
- (ii) There was no copulation during the first reproductive cycle. When did ovulation occur during the first reproductive cycle and how was it brought about? (2 marks)
- (iii) On the graph above, sketch a curve to show the changes in oestrogen concentration during the third reproductive cycle. (2 marks)
- (iv) Copulation took place on the fifth day of the second reproductive cycle. Using the information from the graph, state two effects of copulation on the reproductive cycle. (2 marks)
- (v) In view of the effects of copulation on the reproductive cycle you answered in (iv), explain why the effects could increase the chance of successful reproduction. (2 marks)

1. (b) Usain Bolt's world record of 9.58 seconds for the 100 m men's sprint is unbeaten.



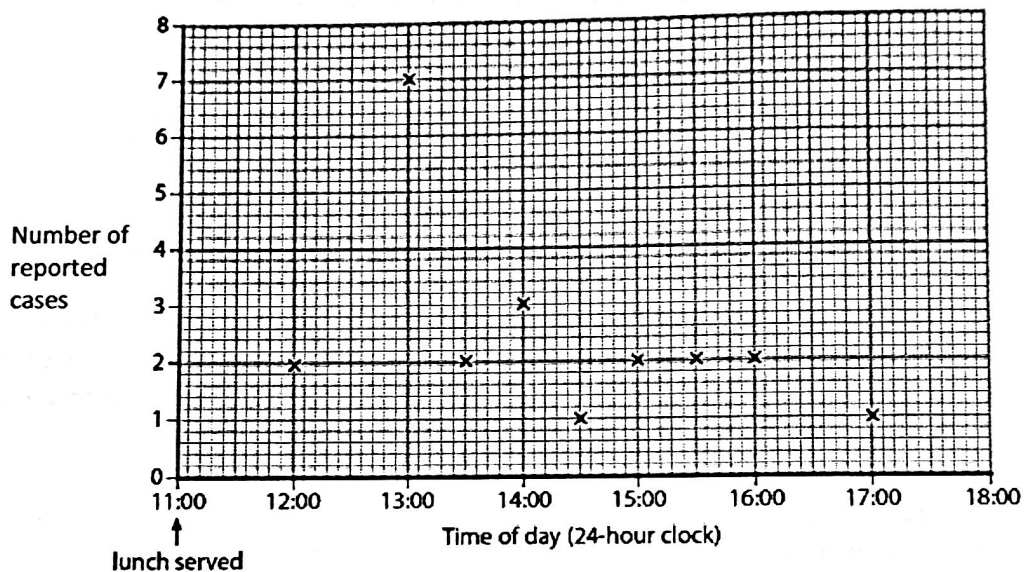
(Source: © Ian MacNicol/ Getty Images)

In energy-demanding sports such as 100 m sprint, cardiovascular and respiratory fitness is one of the pivotal factors in determining athlete's performance. Sprint athletes have to increase their rate and depth of breathing as quickly as possible once the race has started. They have to increase their cardiac output too within a very short time.

- (i) What is meant by the term 'cardiac output'? (1 mark)
- (ii) It is found that the sprinter's plasma lactate concentration rises abruptly soon after the start of 100 m sprint. How does the rise in plasma lactate concentration stimulate the nervous system to bring about an increase in cardiac output during the race? (3 marks)
- (iii) During the race, sprinters generate a lot of heat due to vigorous muscle contractions. Describe how the nervous system maintains the body temperature during the race. (3 marks)
- (iv) The urine output of sprinters drops after the race. With reference to the hormonal control of osmoregulation, explain how the drop in urine output is brought about. (3 marks)

SECTION B Microorganisms and Humans
Answer ALL parts of the question.

2. (a) G12 students of Diocesan Boys' School organized a lunch party to celebrate the last school day of their secondary schooling. They ordered sushi from a Japanese restaurant and ate it in the classroom. Two students had abdominal pain, vomiting and diarrhoea one hour after the party and successive cases of similar symptoms were reported in the following hours. The reported cases were classified by the Centre for Food Safety as food-borne illness. Graph 1 below shows the number of reported cases after the lunch party.

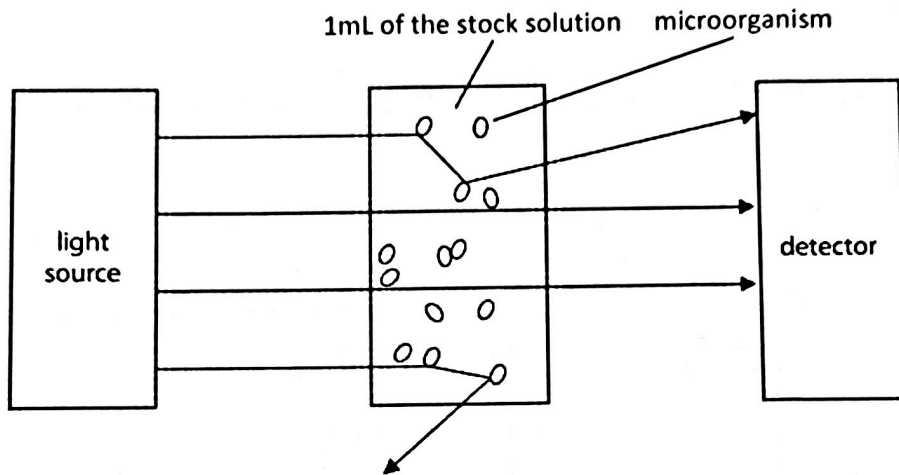


Graph 1

- (i) Based on the information from the graph, which type of food-borne illness would the reported cases most likely belong? Explain your answer by citing one piece of evidence from the graph. (3 marks)

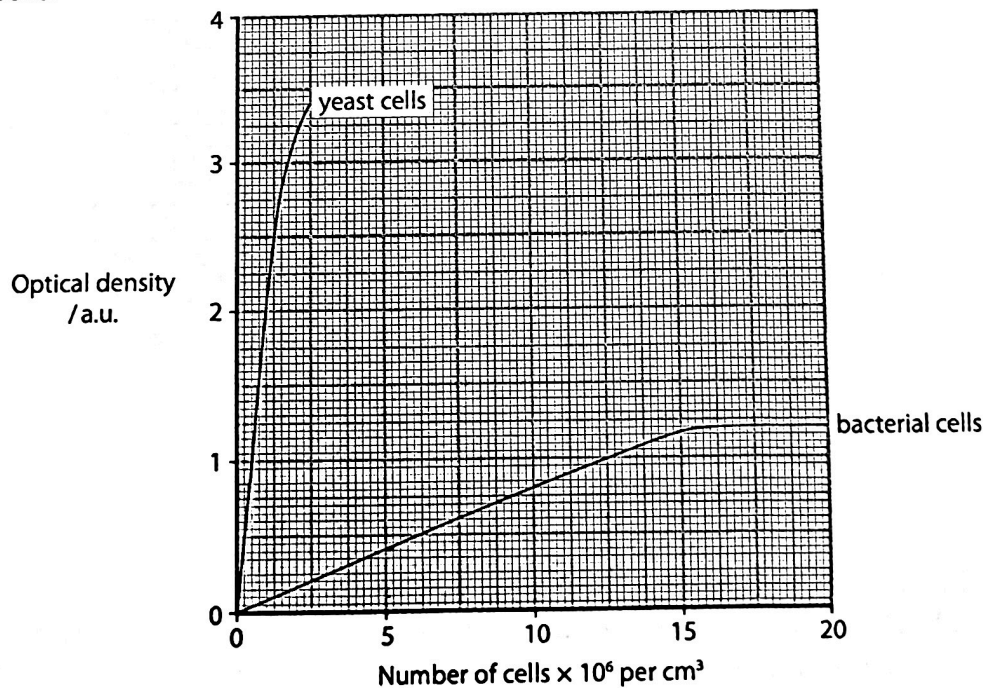
The Centre for Food Safety investigated the reported cases by conducting a preliminary measurement using optical method to find out the number of microorganisms in the leftover sushi as follows:

100 grams of leftover sushi were blended with water to make up to a 100 mL stock solution. Light was shone through 1mL of the stock solution and a detector recorded the optical density. The diagram below shows what happened to light shone at 1mL of the stock solution.



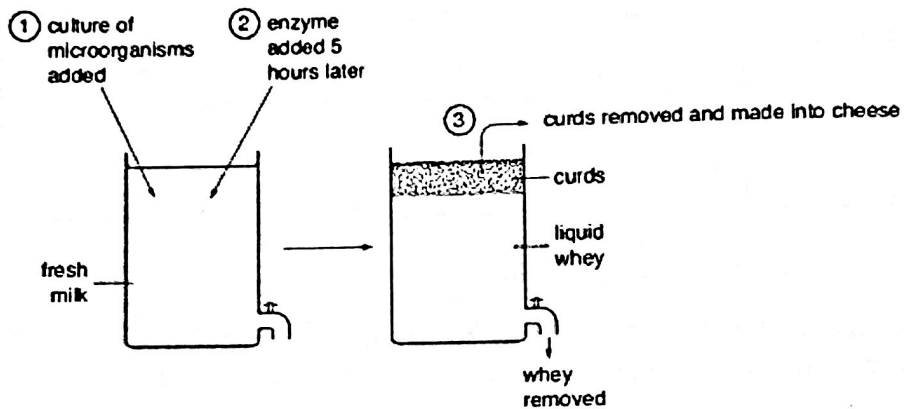
- (ii) Give **one** advantage and **one** limitation of using optical method to find out the number of microorganisms in the stock solution. (2 marks)

The number of microorganisms in 1mL of the stock solution can be determined using a calibration curve. The graph below shows a calibration curve for bacterial cells and yeast cells.

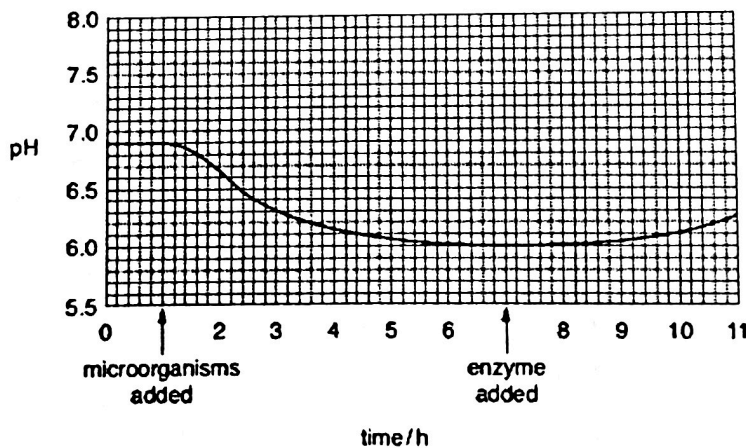


- (iii) The optical density of 1mL of the stock solution was found to be 0.4 a.u. Calculate the number of microorganisms per gram of leftover sushi using the calibration curve for bacterial cells. Show your working. (2 marks)
- (iv) According to the guidelines adopted by the Centre for Food Safety, food is considered acceptable for human consumption if the number of living microorganisms per gram of food is less than 10 000 000. Based on your answer to (iv), what would you conclude about the type of food-borne illness to which the reported cases belong? Explain your answer. (3 marks)

2. (b) The diagram below shows some of the stages in the manufacture of a type of cheese.

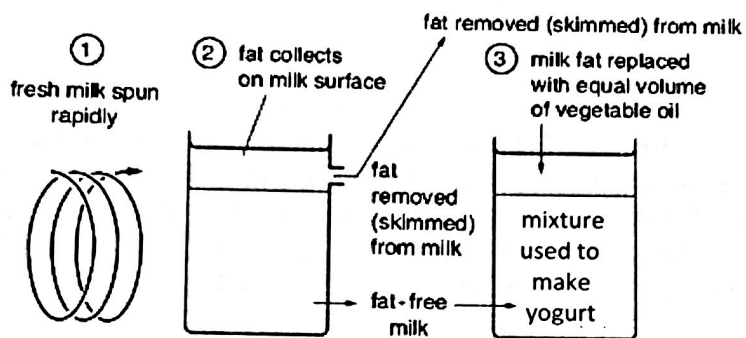


The graph below shows the changes in pH which occurred during the first few hours of this process.



- (i) Name the type of microorganisms added to the milk. (1 mark)
- (ii) State the significance of the drop in pH to the production of cheese. (2 marks)
- (iii) Name *two* chemical substances that can be found in curds. (1 mark)

The diagram below shows how milk is treated before it is used to make yogurt.



- (iv) Explain why the treatment shown in the diagram may make yogurt healthier to eat than cheese. (2 marks)
- (v) How does the texture and flavour of yogurt differ from those of cheese? Explain the differences in texture and taste by stating the differences in their production processes. (4 marks)